

Appl. No. 10/699,440
Amdt. dated January 10, 2006
Reply to Office action of December 13, 2005

Amendments to the Claims:

The listing of present claims in the application:

Listing of Claims:

1 Claim 1 (Original): A film surface imprinted with nanometer-sized
2 particles to produce micro- and/or nano-structured electron and
3 hole collecting interfaces, comprising;
4 at least one transparent substrate;
5 at least one photoabsorbing conjugated polymer applied on a
6 first said substrate, wherein said conjugate polymer includes
7 polybutylthiophene (pbT);
8 a sufficient amount of nanometer-sized particles including
9 multiwalled carbon nanotubes (MWNT) to produce a charge
10 separation interface;
11 at least one transparent polymerizable layer including a
12 sol-gel or monomer,
13 said MWNT embedded in said conjugated polymer to produce a
14 mixture and applied on a second said substrate to form a MWNT
15 bearing surface film layer to form a stamp surface;
16 wherein said stamp surface is imprinted into the surface of
17 said polymerizable film layer to produce micro- and/or nano-
18 structured electron and hole collecting interfaces;
19 polymerizing said polymerizable film layer to promote
20 shrinkage to form a conformal gap between said MWNT stamp surface

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21 and said surface of said polymerizable film layer; and
22 filling said gap with at least one photoabsorbing material
23 to promote the generation of photoexcited electrons and transport
24 to the charge separation interface.

1 Claim 2 (Original): The film according to claim 1, wherein either
2 said polymerizable layer and said conjugated polymer is applied
3 by processes comprising at least one of spin-coating, dip-
4 coating, spray-coating, flow-coating, doctor blade coating, and
5 screen-printing.

1 Claim 3 (Original): The film according to claim 1, wherein said
2 nanometer-sized particles having average particle sizes of about
3 1 nm to about 100 nm in diameter and up to about 1 nm to about 1
4 cm in length.

1 Claim 4 (Original): The film according to claim 3, wherein said
2 nanometer-sized particles having average particle sizes of about
3 1 nm to about 100 nm in diameter and up to about 1 nm to about
4 500 nm in length.

1 Claim 5 (Original): The film according to claim 1, wherein said
2 nanometer-sized particles further comprises at least one of SWNT,
3 and nanocrystals of semiconductor materials.

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1 Claim 6 (Original): The film according to claim 5, wherein said
2 nanocrystals of semiconductor materials comprises at least one of
3 CdSe, metal nanowires, and metal-filled carbon nanotubes.

1 Claim 7 (Original): The film according to claim 1, wherein
2 applying said polymerizable film layer ranging in thickness from
3 about 1 nm to about 1 mm.

1 Claim 8 (Original): The film according to claim 1, wherein
2 applying said conjugated polymer mixture ranging in thickness
3 from up to about 100 nm.

1 Claim 9 (Original): The film according to claim 1, wherein said
2 polymerizable layer comprises at least one monomer film.

1 Claim 10 (Original): The film according to claim 1, wherein said
2 polymerizable layer comprises at least one sol-gel film.

1 Claim 11 (Original): The film according to claim 1, wherein said
2 sol-gel includes absolute alcohol and ultrapure water in a ratio
3 of about (1:0.025) and said metal oxide includes titanium oxide
4 and/or zinc oxide.

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1 Claim 12 (Original): The film according to claim 1, wherein said
2 monomer comprising at least one of oxadiazole, aniline, and
3 pyrrole.

1 Claim 13 (Original): The film according to claim 1, wherein said
2 photoabsorbing material comprises at least one of thermotropic
3 liquid crystalline materials, polybutylthiophene
4 (pbT)/chlorobenzene, and polyelectrolytes.

1 Claim 14 (Original): A film surface imprinted with nanometer-
2 sized particles prepared by a process to produce micro- and/or
3 nano-structured electron and hole collecting interfaces,
4 comprising:
5 providing at least one transparent substrate;
6 providing at least one photoabsorbing conjugated polymer;
7 providing a sufficient amount of nanometer-sized particles
8 to produce a charge separation interface;
9 providing at least one transparent polymerizable layer
10 including a sol-gel or monomer;
11 embedding said nanometer-sized particles in said conjugated
12 polymer;
13 applying said polymerizable layer on a first said substrate
14 to form a charge transport film layer;

15 applying said conjugated polymer/nanometer-sized particle
16 mixture on a second said substrate to form a nanometer-sized
17 particles bearing surface film layer, wherein said nanometer-
18 sized particles form a stamp surface;
19 imprinting said stamp surface into the surface of said
20 polymerizable film layer to produce micro- and/or nano-structured
21 electron and hole collecting interfaces;
22 polymerizing said polymerizable film layer to promote
23 shrinkage to form a conformal gap between said stamp surface and
24 said surface of said polymerizable film layer; and
25 filling said gap with at least one photoabsorbing material
26 to promote the generation of photoexcited electrons and transport
27 to the charge separation interface.

1 Claim 15 (Original): The film according to claim 14, wherein said
2 imprinting includes compressing and thereafter, solidifying said
3 stamp surface into said surface of said polymerizable layer.

1 Claim 16 (Original): The film according to claim 14, wherein said
2 nanometer-sized particles having average particle sizes of about
3 1 nm to about 100 nm in diameter and up to about 1 nm to about 1
4 cm in length.

1 Claim 17 (Original): The film according to claim 16, wherein said

2 nanometer-sized particles having average particle sizes of about
3 1 nm to about 100 nm in diameter and up to about 1 nm to about
4 500 nm in length.

1 Claim 18 (Original): The film according to claim 14, wherein said
2 nanometer-sized particles further comprises at least one of SWNT,
3 and nanocrystals of semiconductor materials.

1 Claim 19 (Original): The film according to claim 18, wherein said
2 nanocrystals of semiconductor materials comprises at least one of
3 CdSe, metal nanowires, and metal-filled carbon nanotubes.

1 Claim 20 (Original): The film according to claim 14, wherein
2 applying said polymerizable film layer ranging in thickness from
3 about 1 nm to about 1 mm.

1 Claim 21 (Original): The film according to claim 14, wherein
2 applying said conjugated polymer mixture ranging in thickness
3 from up to about 100 nm.

1 Claim 22 (Original): The film according to claim 14, further
2 comprising electrophoretically depositing said nanometer-sized
3 particles onto said polymerizable layer.

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1 Claim 23 (Original): The film according to claim 22, wherein said
2 nanometer-sized particles include TiO_x nanometer-sized particles.

1 Claim 24 (Original): The film according to claim 14, wherein said
2 sol-gel includes absolute alcohol and ultrapure water in a ratio
3 of about (1:0.025) and a metal oxide.

1 Claim 25 (Original): The film according to claim 24, wherein
2 said metal oxide comprises at least one of inorganic metal salts
3 and metal organic compounds.

1 Claim 26 (Original): The film according to claim 25, wherein
2 said metal organic compounds include metal alkoxides comprising
3 at least one of titanium isopropoxide and zinc butoxide.

1 Claim 27 (Original): The film according to claim 14, wherein
2 said monomer comprising at least one of oxadiazole, aniline, and
3 pyrrole.

1 Claim 28 (Original): The film according to claim 14, wherein
2 said substrate acts as an electrode by comprising a coating of at
3 least one transparent metal oxide including SnO₂:F, SnO₂:In
4 (ITO), and Au.

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1 Claim 29 (Original): The film according to claim 14, wherein
2 said substrate acts as an electrode by comprising a coating of at
3 least one transparent metal oxide being conducting polymers
4 including polythiophenes, polypyrroles, polyanilines, and
5 polybutylthiophenes.

1 Claim 30 (Original): The film according to claim 14, wherein
2 said conjugated polymer includes pbT dissolved in chlorobenzene.

1 Claim 31 (Original): The film according to claim 14, wherein
2 said photoabsorbing material comprises at least one of
3 thermotropic liquid crystalline materials, polybutylthiophene
4 (pbT)/chlorobenzene, and polyelectrolytes.

1 Claim 32 (Original): The film according to claim 14, wherein
2 said substrate comprises at least one of silicon, silicate,
3 plastic, and plastic-like materials.

1 Claim 33 (Original): The films surface imprinted with nanometer-
2 sized particles are obtained by the process defined in claim 14.

1 Claim 34 ((Original): The film according to claim 1, wherein said
2 film being utilized in a photovoltaic device or other light
3 guiding device.

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Claim 35 (canceled).

Claim 36 (canceled).